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A new mosquito of the genus *Topomyia* (Diptera, Culicidae) from a *Nepenthes* pitcher plant in a Bario highland of Sarawak, Malaysia

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Abstract: A new species, *Topomyia* (*Suaymyia*) *nepenthicola*, is described from a Bario highland in Sarawak, Malaysia. The adult male and female, pupa and larva are described in detail and illustrations of the male genitalia, pupa and larva are provided. The larva of *To. nepenthicola* breeds in the pitcher plant, *Nepenthes stenophylla*. It has conspicuous maxilla.

Key words: *Topomyia nepenthicola*, new species, Culicidae, *Nepenthes*, Sarawak, Malaysia

The genus *Topomyia*, consisting of two subgenera (*Topomyia* and *Suaymyia*), is known mainly from the Oriental Region and occurs in Malaysia, Indonesia, Philippines, Thailand, and Southern China, with only one species in Taiwan and Japan (Thurman, 1959; Knight, 1978; Knight and Stone, 1977; Lu et al. 1997; Miyagi and Toma, 2005, 2006; Toma and Mogi, 2003). As far as we know, a total of 21 species of the subgenus *Suaymyia* have been described and the larvae breed mainly in bamboo internodes, with several species breeding in the leaf axils of many kinds of plants. A new species of *Suaymyia* found in a Bario highland of Sarawak, Malaysia is recognized for the first time from a *Nepenthes* pitcher plant. The terminology used for the adults and immature stages follows mainly Harbach and Knight (1980, 1981), partly Belkin (1962), and Harbach and Peyton (1993).

Topomyia (*Suaymyia*) *nepenthicola*

Miyagi and Toma, sp. n.
(Figs. 1–3; Tables 1, 2)

Male.

Head: Black with somewhat purple reflections in dorsal aspect; vertex covered closely with broad flat dark scales; apical part of vertex with a diamond shaped silver scale patch; a line of white scales along ocular suture; erect scales and narrow decumbent scales absent on occiput; a pair of blackish interocular and several black ocular setae present; postgena covered with a small silver scale patch. Clypeus small, dark brown. Maxillary palpus black, short, about 0.11 of proboscis covered with dark scales. Proboscis slender, 2.25 mm, as long as or a little longer than antenna; slightly swollen at the distal end and covered with dark scales dorsally and with a ventral line of white scales extending from base to about 4/5 length of proboscis. Pedicel covered closely with dark scales.

Thorax. Scutum covered densely with

velvety black scales and with a median silvery line from anterior promontory to prescutellar area; the line consisting of double rows of overlapping flat silvery scales; 2 prescutellar, many antealar and supraalar setae present. Thoracic pleura covered densely with silvery reflected spatulate scales on upper and lower postpronotal, antepronotal, upper proepisternal, postspiracular, subspiracular, prealar, upper and lower mesokatepisternal, upper mesepimeral and metepisternal areas. Conspicuous black setae absent on the pleuron, except about 10 antepronotal, 1 well developed postpronotal and 2 lower antepronotal setae. Scutellum with a patch of flat silvery scales and 1 or 2 well developed setae on median lobe; 3 or 4 setae with black spatulated scales on each lateral lobe.

Wing. Length 3.75 mm: Cell R_2 about 2.50 of stem R_{2+3}; alula without scale on margin: upper calypter with 10–14 setae. Haltere: Scabellum pale, pedicel and capitellum with dark scales.

Legs. Coxae yellowish brown, with silvery-white scales, trochanters with some dark scales dorsally at apex; femora, tibiae and tarsi dark scaled dorsally, femora and tibiae and basal segment of tarsi white scaled ventrally. Forefemur 2.75 mm. Forefemora as long as or a little longer than mid- and hindfemora; first tarsal segment of all legs (Ta-I_1–Ta-III_1) as long as each tibia (Ti-I–Ti-III). All unguis small equal in size, without a lateral tooth.

Abdomen. Terga dark-scaled without white dorsal patch on all segments, slightly marked lateral bands on all segments, the bands broad in segments I, IV and V (Fig. 1C). All sterna with white spatulate scales.

Genitalia (Fig. 1A). Lobes of tergum IX (IX-TL) widely separated by narrow bridge, each lobe attenuated apically, terminating in single stout large blade-like seta and one seta closely spaced on inner basal margin of each lobe. Gonocoxite. Length about 2.0 times breadth at middle. Dorsomedian lobe (DML) with several well developed setae apically curved. Claspette (CL) short stem with a long gradually twisted prominent seta. Gonostylus (Gs) complicated: accessory basal lobe setaceous (Bs-Gs). Apical lobe rectangular, about 13 leaflets in a row, each with an apical seta (Ap-Gs). A large gonostylar claw curved apically. Aedeagus and paraproct (Ae) long and curved apically. Phallosome and paramere as PH and Pr in Fig. 1.

Female.

Wing about 3.75 mm. Proboscis 2.25 mm. Forefemur 2.75 mm. Abdomen 2.6 mm; resembles male except abdominal white spots: terga (Fig. 1C) covered with dark purple-brown scales dorsally; segment I with a lateral patch of white scales; II with a patch of white scales entirely; III with lateral patch; IV and V with lateroapical patch which extends dorsally; VI and VII without lateral white patch.

Pupa (Fig. 2, Table 1).

Abdomen 4.13 mm long (from segments I to VIII). Trumpet 0.40 mm, index 3.8. Paddle 0.68. Chaetotaxy as figured and given in Table 1. Metanotum and cephalothorax (Fig. 2B): Trumpet (Fig. 2C) yellowish brown in color, with fine sculpturing, not strongly broadened towards pinna. Seta 1-CT long, conspicuous, single or bifid. Abdomen: Microtrichia on all segments and paddle uniformly; abdominal seta 3-II, III single, small. Seta 5-IV–VI single, large; seta 9-VII, large, with 7–10 branches, 9-VIII large with more than 10 branches. Paddle long, ending in a blunt point, uniformly and lightly pigmented with a distinct midrib and without minute marginal spicules. Male genital lobe extending to about 0.86 of paddle, female to 0.47.

Fourth-instar Larva (Fig. 3, Table 2).

Head (Fig. 3B) length 0.95 mm, width 1.24 mm. Siphon 0.90 mm. Chaetotaxy in Table 2 and as figured. Mental plate (Fig. 3 C) with median tooth and 6–7 smaller

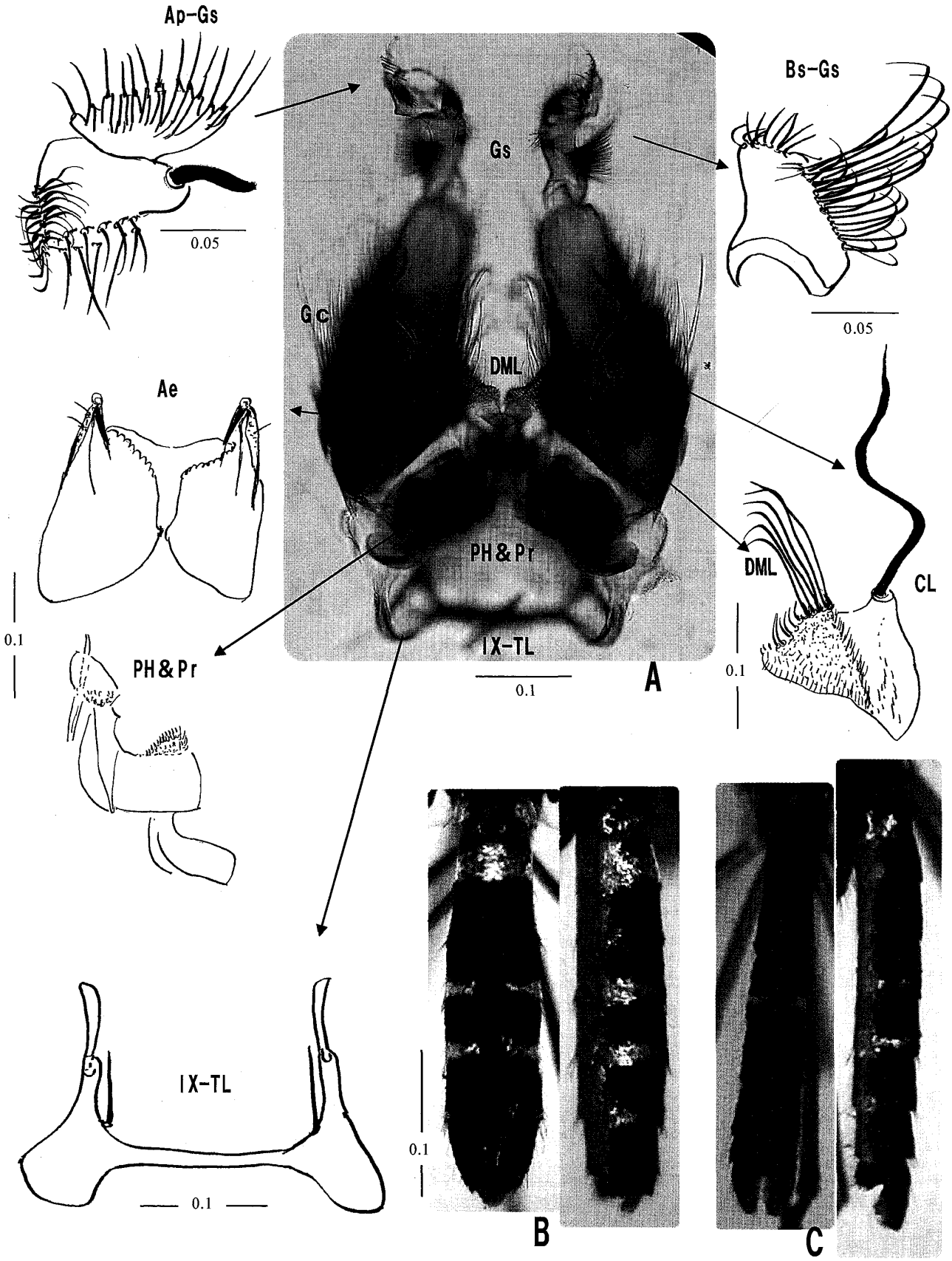

Fig. 1. Male genital organs (A) and female and male abdomen (B, C) of *Topomyia* (*Suaymyia*) *nepenthicola*. A, male genitalia dorsal view; gonostylus (Gs), apical (Ap-Gs) and basal (Bs-Gs) parts of gonostylus, gonocoxite (Gc), aedeagus or paraproct (Ae), dorsomesal lobe (DML) and claspette (CL), phallosome and paramere (PH & Pr), tergum IX (IX-TL); B, female abdomen (left, dorsal and right, ventral views); C, male abdomen (left, dorsal and right ventral views). Scales in mm.

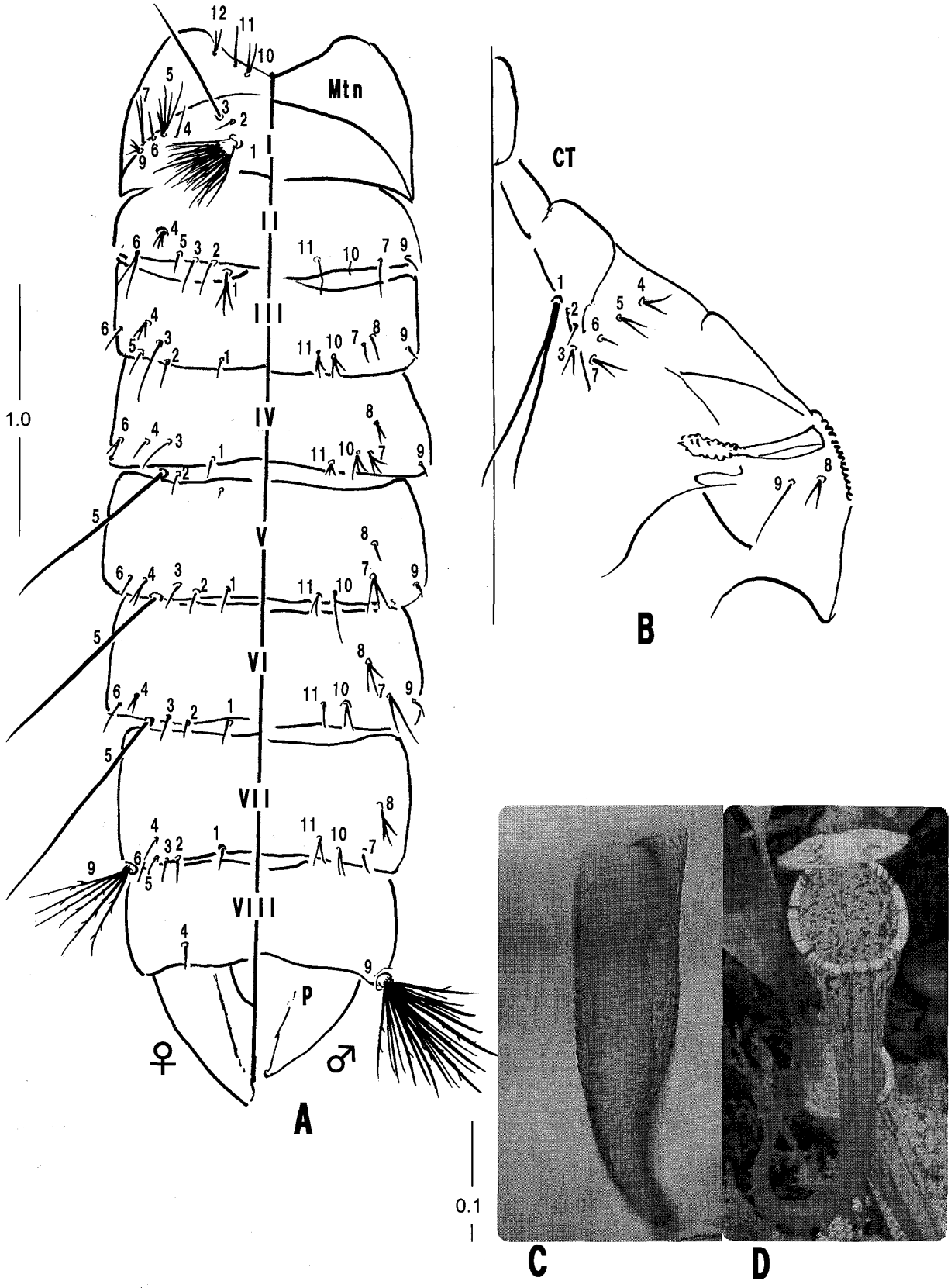

Fig. 2. Pupa and trumpet of pupa and larval habitat of *Topomyia* (*Suaymyia*) *nepenthicola*. A, abdomen; B, cephalothorax (CT); metanotum (Mtn), C, trumpet; D, larval habitat, *Nepenthes stenophylla*. Scales in mm.

Table 1. Chaetotaxy of the pupae of *Topomyia* (*Suaymyia*) *nepenthicola*, sp. n.

Seta no.	Cephalothorax	Abdominal segments							
		I	II	III	IV	V	VI	VII	VIII
0	—	—	—	—	—	—	—	—	—
1	2	4–6*	3, 4	1	1	1	1	1	—
2	1–3	1	1	1–3	1	1, 2	1, 2	1	—
3	2, 3	1	1	1	1–3	1, 2	1, 2	1	—
4	2	1	1–3	1–4	1, 2	1–2	1–4	1, 2	1
5	2	3–5	1	1	1	1	1	1	—
6	1	1	1, 2	1, 2	1, 2	1	1	—	—
7	2	1–3	1	1–3	1–3	1–5	2	1	—
8	1, 2	—	—	1, 2	1, 2	1	1–3	1–3	—
9	1, 2	1–3	1	1	1	1	1	4–6**	10–15**
10	2	—	1, 2	1–3	1–3	1	1–3	1, 2	—
11	1	—	0, 1	1–3	1–3	1–4	1	1–3	—
12	1, 2	—	—	—	—	—	—	—	—

* Fanlike setae with 3, 4 aciculate dendritic branches.
** Barbed.
Most of the small setae were single with 2–4 apical forks.
Obsorate and missing setae are shown with a hyphen (—).
Specimens examined: 2 pupae and pupal exuviae from Bario.

teeth on either side. Mouth parts modified for predation. Mouth brushes stout pectinate. Mandible black with a large apical tooth and 3 ventral teeth. Maxilla (Fig. 3 D) large. Maxillary bundle (MxBn) strongly developed, longer than length of maxillary body (MxBo), index (MxBn/MxBo) 2.19; a row of several well developed MxB (Maxillary brush); apical tooth (AT) small process; seta 4 on MxBo well developed, single, situated at basal 0.8 of maxillary body. *Antenna* (Fig. 3E) length about 0.31 of head. Seta 1-A weak, single, arising 0.76 from base, extending over tip of antenna. Seta 1-C stout, simple; seta 11 comparatively well developed, single. Abdominal setae pigmented. Stellate setae with aciculate branches present in seta 5 on segments III–VI. Seta 6-II, III long, 4–8 branched with aciculate, 6-III–VII 1 or 2 branched. *Siphon* (Fig. 3F, I): usually long, variable length, broad at base, tapering, lightly pigmented with fine speckles evenly, index 9.0. Many small pecten teeth (Fig. 3G) placed irregularly. Ventral setae (1a) of siphon 11–13, unpaired, well developed into strong, simple setae, apical 2 small single or bifid. Dorsal seta (2a-S) 3 pairs, the basal 2 single, the apical one small 2–4 branched. Comb scales 14–16 in an irregular row; individual scales (Fig. 3 H) usually pointed and with fine fringes towards base. Saddle incomplete, with fine spines on posterior margin. Segment X (Fig. 3I), 1-X 4 branched with aciculate, 2-X 8–12 branched, 3-X bifid; 4-X 8–12. Gill elongate, tapering.

Type material. Holotype male (060917-15) on pin with L (larval) and P (pupal) exuviae mounted on a slide (343) and genitalia on a slide (G79) with the following collection data: Bario Pa-Umor (approximately 1,200 m), Sarawak, East Malaysia, collected as larva from pitcher plants (*Nepenthes stenophylla*) and reared to adult in the laboratory.

Paratypes. 2 ♀♀(060919-1), L and P exuviae on slides (441 and 402); 2 larval exuviae and one larva (060919-1). Bario Pa-Umor, Sarawak, collected from the pitcher plants. All specimens were collected by I. Miyagi and T. Toma. Specimens will be deposited in the Sarawak Museum, Kuching, Malaysia and U.S. National

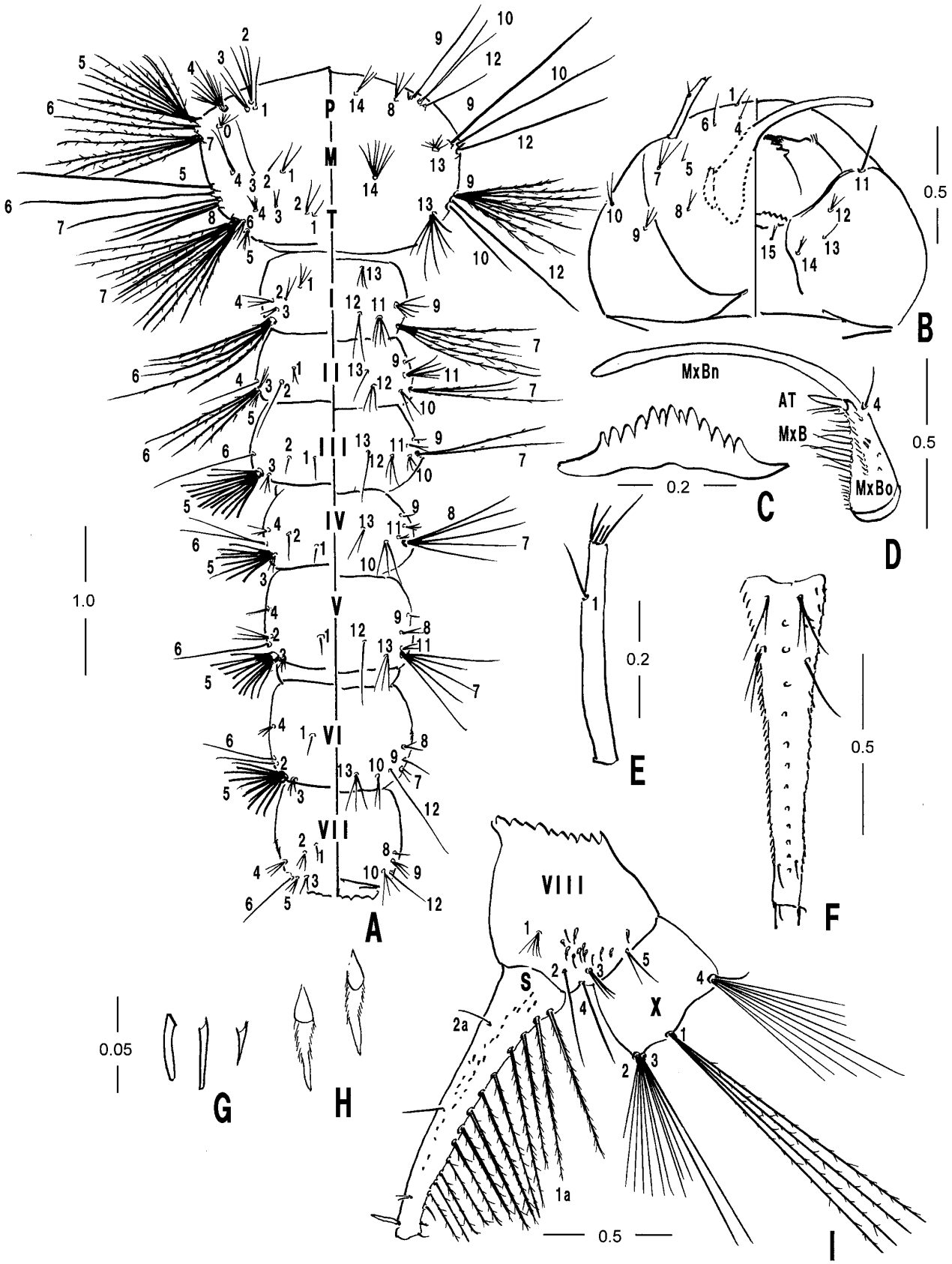

Fig. 3. Larva of *Topomyia* (*Suaymyia*) *nepenthicola*. A, thorax and abdominal segments I–VII; B, head; C, mentum; D, maxilla; E, antenna; F, siphon in ventral view; G, pectin teeth; H, comb scales; I, abdominal segment VIII and siphon (S). Scales in mm.

Table 2. Chaetotaxy of the larvae *of Topomyia* (*Suaymyia*) *nepenthicola*, sp. n.

Seta no.	Head	Thorax			Abdominal segments							
		P	M	T	I	II	III	IV	V	VI	VII	VIII
0	—	4–8	—	—	—	—	—	—	—	—	—	—
1	1	1–2	1, 2	1, 2	3–4	2, 3	1	1	1	1	1	4–6
2	—	3, 4	1, 2	1, 2	2, 3	1, 2	1	1–3	1–3	1, 2	1–3	1
3	—	2–4	1	2, 3	2, 3	3	1–3	1, 2	2–4	1–3	1, 2	2, 3
4	1	6–11*	1, 2	1–3	2, 4	1	—	1–3	1, 2	3	3, 4	1
5	1	5–10*	1*	3–5	—	3, 4	10–13**	7–12**	9–13**	9–13**	2–3	2
6	1	2–4*	1*	2, 3	5–8*	4–6	1	1, 2	1	1, 2	1	—
7	1–4	5–12*	1*	10–14*	4–6*	3*	2, 3*	4, 5*	4, 5*	1, 2	—	1-X=4
8	1–3	3–5	3	—	—	—	—	1–3	1–3	1–3	1	
9	2–4	1, 2*	1*	6–10*	4–6	1	1, 2	1	1	1	3, 4	2-X=8–12
10	1, 2	2, 3*	1, 2*	1, 2	—	2–3	3, 4	3–5	—	2	1–3	
11	1	—	—	—	5–7	2–4	1, 2	1–3	1, 2	—	—	3-X=2
12	1–3	1*	1*	1*	2	3–5	1–3	—	1	1	1	
13	1, 2	—	4–7	7–10*	3, 4	1, 2	1	2, 3	3, 4	3	—	4-X=8–12
14	2–4	3, 4	6–8	—	—	—	—	—	—	—	—	—
15	2, 3	—	—	—	—	—	—	—	—	—	—	—

*Barbed. **Stellate.

Obsolete and missing setae are shown with a hyphen (−).

Specimens examined: 2 fourth-stage larvae and larval exuviae from Gombak, Malaysia.

Museum, Washington DC, U.S.A.

Taxonomic Discussion. *Topomyia nepenthicola* bears a superficial resemblance to *Topomyia* (*Suaymyia*) *argenteoventralis* Leicester, 1908 collected from the leaf axils of taro plants (Colocasia/Alocasia) in mountainous areas of Malaysia and Indonesia (Edwards, 1922; Miyagi and Toma, 2006), but is distingushed from it in all developmental stages. In the male genital organs of the latter species, the claspette has a long rod-like dorsal lobe and apically flared flange (a peculiar flower-like terminal appendage) and several setae on the apical part of the gonostylus, whereas *To. nepenthicola* has a short rod-like dorsal lobe with an apical long winding seta and a series of 10 to 13 leaflet setae on the apical rectangular lobe of the gonostylus. In the pupa, a slight difference is found in the abdominal setae 3-II, III, which are single, long in *To. argenteoventralis* but small in *To. nepenthicola*. The larval stage of *To. nepenthicola* can be distinguished easily by the siphon with 12–14 unpaired strong spine-like barbed setae and modification of the maxilla to a unique apical tooth. The larvae of the new species have been found exclusively in a highly specialized habitat, *Nepenthes* pitcher plants (Fig. 2D) in a Bario highland. We believe that the new species is an ancient derivative of a leaf axil breeder, *To. argenteoventralis*.

Biological notes. The larvae of *To. nepenthicola* were collected exclusively from the pitcher plant *N. stenophylla* in mountainous areas (approximately 1,200 m) of Pa-Umor, Bario Highland, Northern Sarawak. Two other species, *N. gracilis* and *N. veitchii*, are abundant in sandy areas where the vegetation cover is very sparse and composed of only short trees and bushes. The new species was found only in *N. stenophylla* which climbs into the crowns of small trees. The 3rd or 4th instars of the larvae were rarely collected in the mature purple-spotted large (about 15 cm long) pitchers. The larvae are predacious having greatly developed maxillary bundles. At least under laboratory conditions in the lowlands, the aquatic

cycle of this species was prolonged, as seen in other mosquitoes breeding in confined habitats. More than 3 weeks were necessary from 3rd instar to pupa and the pupal stage required 5 days. Several species—*Uranotaenia* spp., *Toxorhynchites* sp., *Tripteroides* spp. and *Culex* spp.—were found in association with *To. nepenthicolar* in the pitchers.

Distribution. Known only from Bario, Sarawak, Malaysia

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